UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
GROUND WATER AND ECOSYSTEMS RESTORATION DIVISION
P.O. Box 1198 Ada,OK 74820

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OFFICE OF
RESEARCH AND DEVELOPMENT

MEMORANDUM

SUBJECT: Arkwood Superfund Site (12-R06-002)

FROM: Scott G. Huling, Environmental Engineer
Applied Research and Technical Support Branch

TO: Stephen L. Tzhone, Remedial Project Manager
Superfund Division
EPA Region 6, Dallas TX

A technical review was conducted on documents pertaining to the ground water remediation efforts at the Arkwood Superfund Site (Omaha, AR). The primary focus was on the document entitled, "2011 Annual Report Arkwood, Inc. (Omaha, AR)". Comments and recommendations are included below. If I can be of assistance to you, please call me at (580) 436-8610.

cc: Linda Fiedler (5203P)
Terry Burton, Region 6
Gregory Lyssy, Region 6
Vince Malott, Region 6
Chris Villarreal, Region 6

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Technical Review Comments and Recommendations:

General Comments

1. It was reported that,

> " A pilot water injection system was installed in late 2005 at the Site. The pilot system was designed to inject groundwater or ozonated groundwater into the subsurface beneath the Arkwood Site to a depth of approximately 25 feet to maintain adequate flow through the spring and to treat residual concentrations of PCP that impact New Cricket Spring."

The primary objective of the Arkwood site ozone treatment system is unclear. In general, the use of ozone in engineered systems is a good oxidant to use to treat PCP and PAH wastes resulting from wood preserving operations. However, the extraction of ground water at the Arkwood site (from the source area), ozonation, and subsequent injection into the subsurface is likely (1) to have good impact on contaminants in the extracted/treated water, but (2) is projected to have limited impact on the treatment of contaminants in the subsurface in the source area. Once injected, ozone depletion in the injected water is rapid and will occur within a very short transport distance from where it is injected. Ozone would therefore have a strong influence over a very short distance from where it was injected (perhaps a few feet, or less), but would have limited/negligible impact beyond this very narrow radial influence. This conceptual model is proposed based on the very high reactivity of ozone, the abundance of reactants in subsurface systems, and the relatively limited mass of ozone that can be dissolved in the water (and subsequently injected). This matter is covered in detail in the following US EPA *Issue Paper* that can be downloaded from the EPA GWERD website (http://www.epa.gov/nrmrl/gwerd/publications.html#oxidation).

> Huling, S.G. and B. Pivetz. 2006. "In-Situ Chemical Oxidation – Engineering Issue". US Environmental Protection Agency, National Risk Management Research Laboratory, R.S. Kerr Environmental Research Center, Ada, OK. EPA/600/R-06/072.

Assuming the treatment objective was to achieve significant contaminant mass reductions in the Arkwood source area, other more aggressive remedial technologies, including in-situ chemical oxidation (ISCO) is recommended. This would require a focused feasibility study to identify and select a remedial technology capable of achieving the treatment objectives.

In the correspondence from the Arkansas DEQ (letter dated April 4, 2011), it was reported that the EPA Region 6 screening table indicates that the concentration of PCP in soil at industrial sites is 2.7 mg/kg. Assuming PCP concentrations at the Arkwood site are greater than this level, additional treatment at the site may be required and a more aggressive approach is needed (as suggested above).

2. It is assumed that the clean up goal is to treat water that emanates from New Cricket spring only using ozone and to release the treated water to Cricket Creek. It is proposed, but clearly not confirmed, that PCP-contaminated ground water, emanating from the contamination

site, is not captured by New Cricket Spring and migrates beyond New Cricket Spring in the ground water. Assuming this is acceptable to EPA Region 6 and the Arkansas DEQ, additional work is not recommended. However, if contaminated ground water bypassing New Cricket Spring represents unacceptable exposure pathways and risk, it is recommended that additional site characterization and a fate and transport investigation be conducted to assess the extent to which this condition may be occurring.

3. An assessment of the ground water quality at New Cricket Spring as a function of (1) ozone treated and injected water at the Arkwood site, (2) untreated injected water at the Arkwood site, and (3) no treatment or injection of water at the Arkwood site, is a complex matter. One approach to assess this issue would be to compare PCP concentrations in the ground water emanating at New Cricket Spring during the years when ozone treatment was being performed (2005-2011), relative to the recent untreated periods (2011-2012), and before 2005 when no treatment or injected water was occurring. Due to fluctuations in the flow at New Cricket Spring, variability in PCP concentrations at New Cricket Spring, variation in rainfall, variability in the direct hydraulic connection between the two locations (TBD), and several other significant fate and transport factors/parameters, this analysis will be difficult and definitive conclusions doubtful. The use of intermediate ground water monitoring wells located between the New Cricket Spring and the Arkwood site where the treated/untreated water is injected (or not injected), could provide insight on this matter. A critical analysis of this issue would also benefit from other site characterization tools including a tracer testing, aquifer testing, etc.

Specific Comments

1. Based on data included in Appendix A, there does not appear to be a correlation between the flow rate in the New Cricket Spring during 2011 and the concentration of PCP that is measured in the water at New Cricket Spring. However, Table 4.1 indicates that there is long term average flow rate data, and presumably PCP ground water data for New Cricket Spring that can be contrasted to assess a potential correlation. It is recommended that such an analysis be performed and include mass flux computations (flow rate × concentration) and other potential correlations.

2. Based on the area encompassed by the Arkwood site (Figure 1) and the downgradient location of the New Cricket Spring, it is doubtful that all the water that passes through/under the Arkwood site emanates (captured) in the New Cricket Spring. Consequently, contaminated water may be bypassing New Cricket Spring and discharging to Cricket Spring elsewhere. In conjunction with general comment no. 2 above, it is recommended that this issue be investigated further.